Analysis and Feedback for Proposed WAC 246-100-197 Rabies—Measures to Prevent Human Disease

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Abstract

Fortunately, Washington State does not have terrestrial rabies. While preserving this condition is an undisputable goal of the Department, it has meant that the lack of practical rabies experience among the members of the workgroup has allowed some unsupported assumptions to pass unchallenged.

> Section 1 of the Significant Legislative Rule Analysis asserts that it deals with "certain animals known to carry rabies." Although a common misconception, rabies is uniformly fatal to these species as well. The time lapse between animals becoming infectious and succumbing to the disease is measured in days; there is no true carrier state in which the animal is infectious without showing symptoms.
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> The use of the list of species also hides a dangerous unwritten assumption. These species are among those most commonly reported as rabid in the United States, but they are also some of the most common species in the United States. Assuming that the probability an individual is rabid is proportional to the number of cases reported in the species is unsupported.
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> No attempt is made by the rule analysis to justify paragraph (5) (a). The implicit assumption is that intrastate commerce in animals should be subject to the same restrictions as importation despite the admission that Washington State does not have terrestrial rabies against which intrastate restrictions would defend.
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> The assertion that "The primary reason Washington does not have endemic terrestrial rabies is the current ban on importation of certain mammals" is also unsupported. Many factors impact the dynamics of rabies in a given area, primarily the density of vector species.
>
> The benefit analysis given for the requirement to vaccinate dogs, cats, and ferrets only quantifies two sources of cost associated with rabies control. It implies that these costs would be eliminated by mandatory vaccination when neither would in fact be significantly diminished.

Closer analysis of these assumptions will show them to be untrue, and the proposed regulations should be re-evaluated in light of this. In addition, there are several places in the proposed text that are clearly erroneous.

> The definition of "Animal exhibitor" is restricted to class C licensees and not higher classes. No reasoning was given in the analysis for denying those with higher classes of permits the same capabilities as are given to class C licensees.

The definition “Hybrid” encompasses all cats and dogs. Since there is no limiter on recursion, any wild ancestor regardless how removed makes an animal hybrid by this definition as these animals were first domesticated a finite time period ago.

The word “confine” is paragraph (4) is meaningless in context. These are captive animals and thus by definition confined. As it reads today, this section merely prevents the wild-caught animals from being released back into the wild for six months. In context, I believe the intent is that the animals be quarantined from direct contact with the public.

We should strive to update this code before adoption to ensure that the regulation is applied as intended rather than being incorrectly interpreted.

Incorrect Assumptions

Import Bans Prevent the Spread of Rabies

The Significant Legislative Rule Analysis states that “The primary reason Washington does not have endemic terrestrial rabies is the current ban on importation of certain mammals.” This claim seems unlikely considering the rate at which rabies can spread without anthropogenic assistance. Childs, et al. quote a figure of 30-47 km/year (Predicting the local dynamics of epizootic rabies among raccoons in the United States 2000) and even without translocation natural barriers such as rivers only delayed the appearance of rabies by 16 months (Real, et al. 2005). Rabies has been in California since it went west with the pioneers, first appearing in the 1850s. (Steele and Fernandez 1991). At the rate that terrestrial rabies spreads, it would have long since made it to Washington if not restrained by addition factors.

That reason is rabies’ strong dependency on the density of potential hosts. As a disease that rapidly and inevitably kills its host, there is a small window in which an infectious animal can infect a replacement. As density drops, the likelihood that this will happen diminishes. To maintain the disease long-term, each rabid animal must infect on average one other animal before succumbing. Once the density drops below this level, each successive generation will have fewer rabid animals than the previous until the disease disappears. Washington’s evergreen forests support a wide range of wildlife, but we do not support the density of raccoons that the Mid-Atlantic States have or the density of skunks from the Midwest.

The SEIR model shows this clearly. I will use the nomenclature and values quoted for raccoons by Child, et al. (2000) (the Coyne et al. solution) except where otherwise noted. The maximum density of animals when rabies is not present can be found by solving for dX/dt to equal zero with all other populations zero. This gives a carrying capacity equal to (a-b)/ɣ.

To make this analysis simpler with a worst case scenario, I am making the percentage of immune animals zero (ρ = 1). Also, at the start of an outbreak the susceptible population is at the maximum value, so X = N = the carrying capacity of the area. Add together exposed hosts and infections hosts to arrive at:

$dH_1/dt + dY/dt = \beta NY - (b + \gamma N)H_1 - (b + \alpha + \gamma N)Y$

b + ɣN = a so make that substitution to get rid of a few variables.

$dH_1/dt + dY/dt = \beta NY - aH1 - (a + \alpha)Y$

When N becomes small enough that $\beta N = (a + \alpha)$ this expression is $-aH_1$ which is negative and the small number of infected animals will die out. β, a, and α are properties of the species and disease versus N which depends on the properties of the area. Several simplifying assumptions for demonstration purposes have made lowered this limit, but this lower bound comes out to $(a + \alpha)/\beta$. Those figures are quoted for raccoon rabies at 1.34/yr, 66.36/yr, and 33.25 km^2/yr (unit corrected). This puts a lower bound on the critical density threshold just above two animals per square kilometer with all worst case figures. The actual critical threshold must be higher than this

Using the complete SEIR model and numerical simulation, it is possible to find the actual critical density. That is, however, outside the scope of these comments as this was intended only as a demonstration that an area can have immunity to a given strain of rabies. We should evaluate whether Washington is even susceptible to any of the existing strains of terrestrial rabies.

Washington does sustain bat rabies, creating quite a different situation for bats as for skunks, raccoons, coyotes, and foxes. For the remained of this feedback, unless otherwise noted, bats are excluded from my discussion.

Incidence is Indicative of Risk

This section singles out several species for special treatment. The analysis does not give a justification for the contents of this list. It appears to be the species most commonly reported rabid from several years ago. More recently, advancements made in canine rabies control along the Texas/Mexico border have drastically cut the number of rabid coyotes. Currently, more bobcats are reported rabid than coyotes. This highlights the problem with regulating based on a list of species. The belief is that a larger number of a species reported rabid indicates that the species is at greater risk. Invariably this leads to a focus only on species that are common and those that live in close proximity to humans. In an area where canine rabies is endemic, there is little reason to consider a coyote more likely to be rabid than a wolf. Due, however, to the significantly higher population density of coyotes and their greater ability to live in close proximity to humans the probability that a rabid coyote is observed is significantly greater.

Additionally, this assumes that data taken from wildlife is applicable to assess risk among captive bred animals. The proposed regulations also do not consider local variations in rabies dynamics. Due to the species affinity of different strains of rabies, there is significant geographic variation in the likelihood that a member of a species is found rabid yet we do not consider the point of origin of an animal. Washington State Department of Agriculture's WAC 16-54-180 (8) does, and could serve as a model for regulation that takes a holistic view of risk instead of the current species based approach.

Benefits of Mandatory Vaccination

The benefit analysis for mandatory rabies vaccination of dogs, cats, and ferrets highlights two sources of cost associated with rabies control and assumes that these costs would be significantly diminished by the proposed rule. The first source is the cost of post-exposure prophylaxis, or PEP, administered to persons bitten by these animals as a precaution against the person contracting rabies. The use of PEP is only required in two cases. The first case is if the biting animal is unavailable to be observed per signs of disease. In this case PEP will still be necessary as it will not be reasonable to assume that the animal was not a stray or that the owner did not

disregard the vaccination requirement. The second case is if the animal develops signs indicative of rabies during the 10 day observation window. Vaccine failures are rare, but known (McQuiston, et al. 2001), and so in this case PEP is still required. The Compendium for Animal Rabies Prevention and Control (National Association of State Public Health Veterinarians, Inc. 2008) prescribes the 10 day observation for biting dogs, cats, or ferrets regardless of the animal's vaccination status. In neither of these cases would mandatory vaccination reduce the usage of PEP.

The other, less significant, source of cost that could be eliminated is the testing of these animals for rabies. If Washington follows the Compendium, this is only done if animals develop signs indicative of rabies while under observation following being bitten or biting a human. Regardless of the vaccination status of the animal, testing is required when symptoms appear. The difference between vaccinated and unvaccinated animals is the time period for which they are to be observed after being bitten by a potentially rabid animal. The longer observation period for unvaccinated animals does create a greater opportunity for another illness to be mistaken as a case of rabies leading to testing, but mandatory vaccination will only reduce a portion of this cost. Immediate euthanasia and testing of stray or unwanted animals is allowed under the guidelines, but discussion at the stakeholder comment meeting indicated that this was already a discouraged practice in this state.

Just above the benefit section is the statement "Appropriately vaccinated pets are protected and therefore will not develop the disease after exposure." This is an extremely dangerous misconception to have; as stated above vaccine failures are known and the accepted procedure for dealing with potential cases of human exposure does not consider the vaccination state of the animal.

Requirements for Import and Ownership

Throughout the entire rulemaking process, subsections (5) (a) and (5) (b) have been bound. The set of persons allowed to import animals and those allowed to purchase animals from in-state sources have been kept the same. Without terrestrial rabies in Washington, the risks for animals of in-state origins are necessarily different than those for animals of out-of-state origin. As a result, the same analysis is not applicable to both. The Significant Legislative Rule Analysis only addresses the risk of importing a rabid animal and does not attempt to (5) (a) separately. Per section (1), "the purpose of this rule is to protect the public from rabies, a deadly disease." Due to the admission that Washington State does not have terrestrial rabies, there does not appear to be any nexus between this rule and its stated purpose.

Unsupported Statements

The Significant Legislative Rule Analysis states that "the increased rate of rabies infection in cats in the United States" increases the risk of human rabies. Appendix A lists known cases of rabies acquired in the United States since monoclonal antibody typing has been used reliably to determine the strains of rabies associated with human cases. None of these cases have been associated with cats. Since rabies strains are highly associated with individual species and do not retransmit well beyond the species barrier and there are no strains associated with cats, the risk of contracting rabies from a cat appears to be minimal. It is more likely that the increased rate of infection is due instead to a rising number of cats and better reporting.

The analysis also refers to raccoons, skunks, foxes, and coyotes as "animals known to carry rabies." This is incorrect; a true carrier state is one in which the animal does not show symptoms of the disease and is capable of infecting humans or other animals. Rabies reliably kills these species as well with a matter of days between the production of virus in the saliva and death. This is well known; for example Charlton et al. report that "although long incubation periods can occur in skunks infected with rabies, there are no convincing reports of a true carrier state, i.e., excretion of virus in saliva of animals that remain free of clinical signs for prolonged periods or that recover from clinical signs and continue to excrete virus." (Skunk Rabies 1991, 318) The preferred term seems to be "vector species."

The analysis also states that "Allow[ing] individual ownership of animals currently prohibited…would require creating a state level certification program to track these high risk animal species." No rationale is given for the interest of the state in animals that originated in this state or have been in the state for an extended period of time. Beyond the normally accepted rabies quarantine period of six months, what interest does the state have in tracking these species? Additionally, the assertion that the state must do so is inconsistent with the proposed WAC 246-100-201 (3) that has the vendors of psittacine birds maintaining tracking themselves, allowing the State to track the disposition of individual animals should the need arise without having to keep records of owners.

Definitions

The definition of "Animal exhibitor" given in this proposed rule is unnecessarily narrow. The United States Department of Agriculture's Animal and Plant Health Inspection Service issues three classes of permits under 7 USC 2131-2159. 9 CFR 1 has separate definitions of "Exhibitor" and "Class C licensee" as they are not the same thing. An entity may meet the definitions of both "Exhibitor" and "Dealer" per USDA and be required to hold a higher class of license. Per USDA, no person may have more than one license, so these entities are unable to have a class C permit. No justification is given for denying the holders of higher permit classes the ability to apply to the Washington Department of Health for an entry permit. Consider the case of a company whose business is managing the importation of animals on behalf of zoos. Per the current proposal, they would be able to import large carnivores from Africa on behalf of their clients, but not a raccoon or skunk from elsewhere in the United States. The definition of "Animal exhibitor" should be expanded to encompass all classes of USDA APHIS permits.

The definition of "Hybrid" is untenably broad, encompassing all cats and dogs. Per the definition, an animal is not a hybrid or wild only if both of the parents are neither hybrid nor wild. By induction, this resolves to a statement that an animal is hybrid if any of its ancestors is wild. As the domestication of animals did in fact occur at some time after the beginning of time, this makes all animals currently alive either wild or wild hybrid. When I first brought this concern up at the informal stakeholder review, it was summarily dismissed. Although I expect the vast majority of local health officials to make sound judgments when dealing with domestic animals that have bitten someone, invariably there will be some that are either misinformed or vindictive towards a particular owner and misuse subsection (8) (c) to order the destruction of an animal that should only have been confined for ten days and observed. It is better to solve the problem now by setting a reasonable definition of hybrid rather than deal with backlash later when an incident occurs.

The definition of “owner” is unnecessarily narrow. Under this definition, only pet animals have owners, and section (3) requires owners of dogs, cats, and ferrets to vaccinate their animals. This means that non-pet animals, such as guard or herding dogs are not subject to the vaccination requirement. We could expand owner to include the responsible party for any animal as per normal usage of the term and then exempt from (3) any additional entities such as research institutions that should be exempt.

Section (4) requires that zoos and exhibitors confine wild-caught animals for six months. The term “confine” is not defined, however. Using the colloquial definition, this would only prevent releasing the animal. This does not seem to be the intent of this section, however. I believe that the intended sematic is closer to “quarantine” in that the animals should not be allowed contact with the public as in a petting zoo or with wild animals. Additionally, quarantine would dictate that if the animal were allowed contact with other animals that were susceptible to rabies, those other animals would not be allowed contact with the public or wild animals until the six months had elapsed. The language should be changed and/or the term defined as currently only the releasing of wild-caught animals back into the wild is prohibited.

Missing From Analysis

There are some notable omissions from the Significant Legislative Rule Analysis that should be considered. First, the costs for mandatory rabies vaccination are never actually estimated. Per animal costs are given, but no total figures are included. It appears from the statement that Washington has 2% of the national population that the author was initially planning to estimate the number of cats and dogs in Washington and thus the total cost. Per the American Pet Products Association’s 2009-2010 survey, there are 93.6 million cats and 77.5 million dogs in the United States. (American Pet Products Association 2010) Washington’s share of that comes out 3.8 million cats and dogs in Washington assuming that our population is consistent with the whole of the United States in pet ownership. Using your figure of $17.70 per annum, this comes out to $66.4 million per annum to vaccinate every cat and dog in Washington. Even if the maximum $134 thousand figure from the benefits were to be taken, the cost imposed would only cover the vaccination of a fifth of a percentage of the cats and dogs in Washington.

Section (3) dealing with the vaccination of animals also appears to be missing an important provision. It currently requires vaccination per veterinary and vaccine manufacturer instructions. As there is no provision for when the two disagree, there will be some unconsidered consequences. If vaccination is only required if both agree, then an individual veterinarian has the ability to decide that vaccination of animals and not cost effective and that it should not be done. Eliminating the ability of a veterinarian to decide not to vaccinate an animal on a cost basis will ultimately end up requiring the use of the more expensive recombinant canary pox virus on cats simply because it is approved for use a couple of weeks earlier. If this section is not completely stricken, there needs to be an age limit below which vaccination is not required to prevent this from being an inadvertent requirement. The most common inactivated virus vaccines can be used at twelve weeks of age, and owners need some time in which to schedule an appointment with their veterinarian, so ninety days is the lowest that we could practically set and would be consistent with WAC 16-54-170.

The Law of Unintended Consequences

In addition to ignoring the natural spread of rabies, the assertion that "The primary reason Washington does not have endemic terrestrial rabies is the current ban on importation of certain mammals" also indicates an unsubstantiated assumption that the presence of the ban prevents the importation of these animals into Washington State. Our analysis of the effect of the proposed rules must take into account the expected percentage of the population that will not comply due either to ignorance or to the belief that they will not be caught or prosecuted. The numbers are not encouraging when it comes to animal control codes. For example, despite registration of cats and dogs being mandatory in King County, only an estimated 25% of persons comply. (Byron 2010)

While the increased severity of both the offense and penalty for violating importation requirements should drive compliance above the levels for registration, this effect is compromised by the practically nonexistent enforcement. This was brought up as an issue by local health officials during the informal stakeholder review. Because violations of the state regulations are misdemeanors the local health officials complained that they were required to go through the prosecutor's office and that they had extremely low priority compared to other offences. They would like a civil enforcement capability, but such could not be granted except by the legislature. The probability that the importation requirements will be checked for a private pet entering the state in a passenger vehicle is vanishingly small.

When these persons import animals into Washington State without the necessary permit from the Department of Agriculture, we are left in a perilous position. If any of these animals were to be involved in a zoonotic disease outbreak, we would be unable to locate animals and persons that may be at risk. The ban certainly reduces the number of these species entering Washington, but for those that do enter we lose the ability to track the animals forwards and backwards that is critical should a zoonotic disease outbreak occur. The overall risk to Washington could be increased by excessively tight restrictions.

Suggestions

It is possible to better protect Washingtonians from rabies with less restrictive measures that are justified by the available evidence. Based on my study, here are some recommendations for how this could be accomplished. First of all, the erroneous definitions that I highlighted above should be corrected.

So long as Washington remains free of terrestrial rabies, proposed subsection (5) (a) is unjustified as a rabies control measure except as it applies to bats. Carnivores should be removed from this subsection entirely. Ultimately, by enabling persons who wished to acquire these animals from an in-state source we could reduce the number of animals imported, especially the number that are current imported illegally. This does leave a couple of weaknesses that we will wish to address elsewhere.

Should a case of rabies occur in a carnivore, we would need the ability quickly shut down the movement of animals out of the area. This authority would come from proposed WAC 246-100-191 (7) dealing with animals associated with a zoonotic disease outbreak. Currently, however, this section prevents the acquisition of animals associated with the outbreak, but does not appear to prevent persons who already own animals

associated with an outbreak from moving the animals into or to a new part of Washington. We would want to strengthen this to prevent persons from moving animals around the state without transfer of ownership if there were to be an outbreak.

It may also be useful to add a parallel to section (4) dealing with the quarantine of imported animals destined for resale or transfer to unlicensed persons. If there were to be a breakdown of rabies control at an out of state breeder or dealer and some of the affected animals were in Washington State, we would need the ability to track them to their current location. This may justify requiring that these animals remain in the possession of licensed parties for the first six months following entry into Washington.

My recommendation for section (5) (a) is as follows:

> All persons are prohibited from acquiring, selling, bartering, exchanging, giving, purchasing, **or** distributing~~, or trapping to retain~~ any ~~bat,~~ skunk, fox, raccoon, or coyote **that has been imported into Washington in the prior six months or any bat**, except a zoological park, animal exhibitor, or research facility.

We may also want to make a concession for animals that were quarantined for a minimum of six months at the origin outside of Washington if sufficient quarantine conditions are met. Trapping from the wild is the domain of other agencies. Without sylvatic rabies in Washington, it does not belong in this section regardless of how bad of an idea it is.

Section (5) (b) is much more difficult, and any solution is going to be contentious. There is compelling evidence that the justification given regarding the introduction of rabies is incorrect as Washington does not have the correct conditions to sustain terrestrial rabies endemically. On the other hand, the purpose of this rule is to avoid human exposure to rabies; one animal with rabies even if unable to spread the disease represents potential human exposure. Persons handling animals that are at risk must know what to look for and what they should do if potentially exposed. Some restrictions will be necessary for animals that originate from rabies endemic areas and for which it cannot be proven that appropriate quarantine procedures were followed. If exhibitors are extended to include class A and B licensees under 9 CFR as well then that may broaden the import as far as is practical though I would prefer to allow persons moving into Washington State that already own one of these animals to be eligible to apply for an entry permit as well.

We also have the issue where this list of species is not clearly a function of actual risk. For example, mongooses are commonly found to be rabid in Puerto Rico and so I would treat their import with just as much care as any of the listed species. I don't see any reason not to broaden (5) (b) to cover all carnivores for which there is not an approved rabies vaccine originating from a rabies endemic area as any argument that can be made about one of the carnivore species listed in the rule could be applied just as well to other species that are less commonly observed rabid. If the list of species is changed, (5) (a) should probably be kept consistent with it.

Section (3) should also be revisited with a more in depth cost-benefit analysis. Without the results of that analysis I cannot make specific recommendations. The cost of PEP, however, does not justify the huge costs imposed by this rule. With our current law, Washington is consistent with most of our neighboring states.

From (Blanton, Palmer and Rupprecht 2010, 653):

Figure 8—State legislation requiring rabies vaccination of cats and dogs, 2009.

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Appendix A
Human cases of rabies in the United States

Date of Death	State	Exposure	Genus	Species/Strain	MMWR
June 5, 1990	TX	Bite	Bat	Tb	March 1, 1991
August 20, 1991	TX	Unknown	Dog/Coyote	Texas/Mexico	November 8, 1991
August 25, 1991	AR	Contact	Bat	Ln/Ps	November 8, 1991
October 8, 1991	GA	Unknown	Bat	Ln/Ps	November 8, 1991
July 11, 1993	NY	Unknown	Bat	Ln/Ps	October 22, 1993
November 9, 1993	TX	Unknown	Bat	Ln/Ps	February 18, 1994
January 18, 1994	CA	Unknown	Bat	Ln/Ps	July 1, 1994
October 11, 1994	AL	Contact	Bat	Tb	April 14, 1995
October 15, 1994	WV	Contact	Bat	Ln/Ps	February 10, 1995
November 23, 1994	TN	Unknown	Bat	Ln/Ps	April 14, 1995
November 27, 1994	TX	Unknown	Dog/Coyote	Texas/Mexico	April 14, 1995
March 15, 1995	WA	Unknown	Bat	Mc	September 1, 1995
September 21, 1995	CA	Contact	Bat	Tb	May 3, 1996
October 3, 1995	CT	Unknown	Bat	Ln/Ps	March 15, 1996
November 9, 1995	CA	Contact	Bat	Ln/Ps	May 3, 1996
October 15, 1996	KY	Unknown	Bat	Ln/Ps	May 9, 1997
December 19, 1996	MT	Unknown	Bat	Ln/Ps	May 9, 1997
January 6, 1997	MT	Contact	Bat	Ln/Ps	August 22, 1997
January 18, 1997	WA	Unknown	Bat	Ef	August 22, 1997
October 21, 1997	TX	Contact	Bat	Ln/Ps	January 16, 1998
October 23, 1997	NJ	Contact	Bat	Ln/Ps	January 16, 1998
December 31, 1998	VA	Unknown	Bat	Ln/Ps	February 12, 1999
September 20, 2000	CA	Contact	Bat	Tb	December 15, 2000
October 10, 2000	GA	Contact	Bat	Tb	December 15, 2000
October 25, 2000	MN	Bite	Bat	Ln/Ps	December 15, 2000
November 1, 2000	WI	Contact	Bat	Ln/Ps	December 15, 2000
March 31, 2002	CA	Contact	Bat	Tb	August 9, 2002
August 31, 2002	TN	Unknown	Bat	Ln/Ps	September 20, 2002
September 28, 2002	IA	Unknown	Bat	Ln/Ps	January 24, 2003
March 10, 2003	VA	Unknown	Raccoon	East US	November 14, 2003
September 14, 2003	CA	Bite	Bat	Ln/Ps	January 23, 2004
May 4, 2004	AR	Bite (Donor)	Bat	Tb	July 9, 2004
June 7, 2004	OK	Transplant	Bat	Tb	July 9, 2004
June 9, 2004	TX	Transplant	Bat	Tb	July 9, 2004
June 10, 2004	TX	Transplant	Bat	Tb	July 9, 2004
June 21, 2004	TX	Transplant	Bat	Tb	July 9, 2004
Survived 2004	WI	Bite	Bat	Unknown	December 24, 2004

September 27, 2005	MS	Contact	Bat	Unknown	March 3, 2006
May 12, 2006	TX	Unknown	Bat	Tb	None
November 2, 2006	IN	Bite	Bat	Ln/Ps	April 20, 2007
October 20, 1007	MN	Bite	Bat	Unknown	May 2, 2008
November 30, 2008	MO	Bite	Bat	Ln	November 6, 2009
Survived 2009	TX	Contact	Bat	Unknown	February 26, 2010
October 20, 2009	IN	Unknown	Bat	Ps	April 9, 2010
November 11, 2009	MI	Contact	Bat	Ln	None

Compiled from combination of CDC MMWR reports and (Blanton, Palmer and Rupprecht 2010).